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Cosmic String Theory: Gravity and Tension

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Abstract

Planets are interconnected via magnetic field lines, which allow flux transfer events. In this paper, a thought experiment is performed whereby the Sun and planets are visualized as a violin with magnetic field lines analogous to strings of the violin. Frequency calculations for vibrating strings between the Earth and Sun compare favorably with measured satellite data for flux transfer events. Ideal Schumann Resonance was calculated using speed of light, diameter of the Earth and Earth's gravity for tension. The force of attraction and repulsion of magnets is analogous to tension and compression resulting from tremendously low frequency (TLF) electromechanical waves. Gravity waves are thus theorized as mechanical waves brought about by the tension of electron strings, which also act dually as electromagnetic waves. Future harmonic analysis of flux transfer wave forms for each planet would add credence to the string theory as the theory of everything.

Keywords

Flux Transfer Events, Gravity, Gravity Wave, String Theory, Schumann Resonance, Theory of Everything

1. Introduction

The story goes that a young Issac Newton was walking in a garden when he saw an apple fall from a tree. Physicists knew that the Earth somehow pulled objects down by the force of gravity. Newton wanted to explore this idea further. According to John Conduitt, who was married to Newton's niece, seeing the apple fall led Newton to the idea that the gravitational force "was not limited to a certain distance from earth, but that this power must extend much further than was usually thought". According to Conduitt's account, Newton then asked: "Why not as high as the Moon?" [1].

It is in this same spirit we address string theory: "Why not as high as the Moon?" The concept of string theory is quite simple. Electrons are not actually particles at all, instead they are loops or "strings". Typically, these strings are so small, they seem to be small points. The various particles discovered in the 20th century are the same type of string. Just like the strings on a violin, these strings are under tension, which means they vibrate at different frequencies, depending on their size or mass. These periods of oscillations or frequency determine what sort of "particle" each string appears to be. Vibrate a string one way and you get an electron. Vibrate it another way, and you get a proton. All the numerous particles discovered are really the same kinds of strings, just vibrating in different ways. One important result of string theory is that gravity is a natural consequence of the theory, which is why scientists think that string theory may hold the answer to possibly uniting gravity with the other forces that affect matter. On the fundamental mass scale, the tension of a string is related to the characteristic mass scale of gravity, namely the Plank mass, $m_p = 2.18\times10^{8}\,\text{kg}$. It is defined as:

$$m_p = \sqrt{\frac{hc}{G}}$$

where c is the speed of light in a vacuum, G is the gravitational constant, and $\hbar$ = 1 is the reduced Planck constant [2].

The average size of a string is near the length scale of quantum gravity, called the Planck length, which is about 10 - 33 centimeters, or about a millionth of a billionth of a billionth of a billionth of a centimeter, which means that strings are way too small to see by current particle physics technology and so particle theorists must devise more ingenuous methods to test the theory than just looking for such incredibly small strings in particle experiments. In string theory, the elementary particles we observe in particle accelerators could be thought of as the "musical notes" or frequency nodes of elementary strings. As in violin playing, the string must be stretched under tension in order to become excited. However, the strings in string theory are floating in spacetime, they are not tied down to a violin. Nonetheless, they have tension.

Scientists have long known that the Sun and Earth are connected. Earth's magnetosphere is filled with electron particles from the Sun that are transported via the solar wind and penetrate the planet's magnetic field. They follow magnetic field lines that can be traced from terra firma all the way back to the Sun's atmosphere. String Theory has been purported as universal theory or theory of everything. If this notion is to become a self-evident truth, then strings must affect all things from those as large as planets to as small as quarks.

In this paper, I examine the application of string theory to planets. Previous work has shown that planets resemble dipole magnets with interacting electromagnetic fields [3]. In this paper, I will be using the Sun and planets as dipole magnets as an example of string theory. Each planet and the Sun are imagined as fixed ends of a violin. The electromagnetic fields are represented as an ensemble of violin strings, which connect the planets by way of magnetic flux. Tension between the planets is thus established by the taught strings, the force of which is caused by the offsetting magnetic field strength of the Sun and planet. Tension is equal to the difference of magnetic repulsion and magnetic attraction of the heavenly bodies. The configuration of the magnets is such that repulsion is greater than attraction, which corresponds to tension being greater than compression. Tension in strings is a mechanical force calculated in Newtons which is identical to units of force of gravity.

2. Acoustic String Theory

The strings of a stringed instrument vary in length, linear density and tension. This gives us a wide range of frequencies and melodious sounds. The larger the linear density, the slower the strings vibrate. The same goes for length; the longer the length of the strings the slower the vibration. This is what causes low frequency in instruments, and I also believe that it is responsible for the tremendously low frequency (TLF) in planetary electromagnetic waves. Planets are at tremendously long distances apart from each other and the linear density, or equivalent charge density, of space is much larger than that of copper for example. The resonant or fundamental frequency of a stretched string is such that the wavelength is twice the length of the string (**Figure 1**) [4].

When a string is plucked, a disturbance is formed and a wave travels in both directions from the point where the string was plucked. The waves travel at a speed that is related to the tension and linear density. Linear density is the measure of a quantity of any characteristic value per unit of length. The linear mass density can then be understood as the derivative of the mass function with respect to the one dimension of the string (the position along its length $m = \mathrm{d}m/\mathrm{d}l$). Applying the basic wave relationship gives an expression for the fundamental frequency:

$$f_1 = \frac{v_{\text{wave on string}}}{2L} \quad [5]$$

Since the wave velocity is given by $v = \sqrt{\frac{T}{m/L}}$, the frequency expression can be put in the form:

$$f_1 = \frac{\sqrt{\frac{T}{m/L}}}{2L}$$

where, T = string tension;

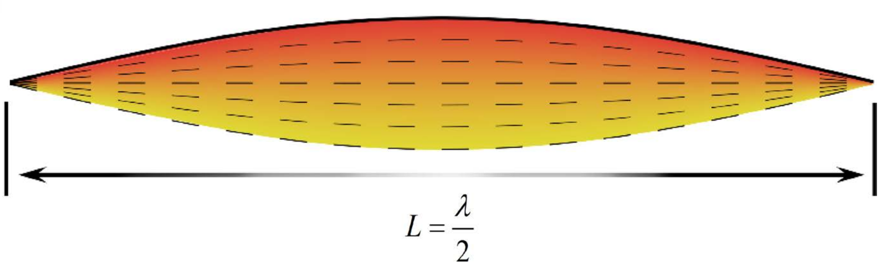

Figure 1. Wavelength of string.

m = string mass;

L = string length.

3. Frequency of Flux Transfer Events to Earth

Using the speed of light, gravity between the Sun and Earth, and distance, Velocity $c = 3\times10^8$ m/s

$$T = \text{Gravity Sun to Earth} = 3.54\times10^{22}\ \text{N} = 7.95\times10^{21}\ \text{lbs}$$

$$L = \text{Distance Sun to Earth} = 150\ \text{billion meters}$$

$$\frac{m}{L} = 9.33\times10^{7}\ \text{g/m}$$

The following numbers are then calculated,

$$f = 0.001\ \text{Hz}$$

$$\text{Period} = 1/f = 1000\ \text{s} = 16.6\ \text{minutes}$$

The period of 16.6 minutes aligns closely with the Periodic Rate of Magneto Pause Flux Transfer Events observed by satellites. There may be a parallel between string theory and flux transfer events. It is postulated that travelling electromagnetic waves are, in a sense, electrical and mechanical connections between planets. These waves would then serve a dual purpose. The first purpose would be to create tension, attraction or gravity and I use the words interchangeably to convey the point these are all units of equivalent force. Secondly, the waves would act as very low frequency electromagnetic radio waves transferring electrical energy from the Sun to the Earth. However, to support this postulated dual relationship, we will need periods that are more exacting to be convincing. I therefore proposed that electrical harmonics and, by analogy, their mechanical reflective waves may be involved, since in most wave systems this is the case.

4. Harmonics of Earth Flux Transfer Events

An ideal vibrating string will vibrate with its fundamental frequency and all harmonics of that frequency [6]. The harmonics are integers of the fundamental. Below is a calculation for the first five harmonics of the Earth and Sun.

$$f1 = 0.001\ \text{Hz} = 16.6\ \text{min}$$

$$f2 = 0.002\ \text{Hz} = 8.3\ \text{min}$$

$$f3 = 0.003\ \text{Hz} = 5.6\ \text{min}$$

$$f4 = 0.004\ \text{Hz} = 4.2\ \text{min}$$

$$f5 = 0.005\ \text{Hz} = 3.3\ \text{min}$$

5. Complex Wave Form Due to Harmonics

The fundamental waveform is the 1$^{\text{st}}$ harmonic waveform. A second harmonic has a frequency twice that of the fundamental, the third harmonic has a frequency thrice that of the fundamental, the fourth harmonic has a frequency four times that of the fundamental and so on. Figure 2 shows the harmonics in the left-hand side column. The right-hand side column shows the complex wave shape generated as a result of the addition of the fundamental waveform and the harmonic waveforms at different harmonic frequencies. The waveform shape of the additive waveform is made up of the amplitude of the harmonic frequencies, and also the phase relationship between the fundamental frequency and the individual harmonic frequencies. A complex wave is made up of a fundamental waveform plus harmonics, each with its own peak value and phase angle. Waveforms such as those shown in Figure 2 apply to violins, power systems and electromagnetic field lines connecting planets [7].

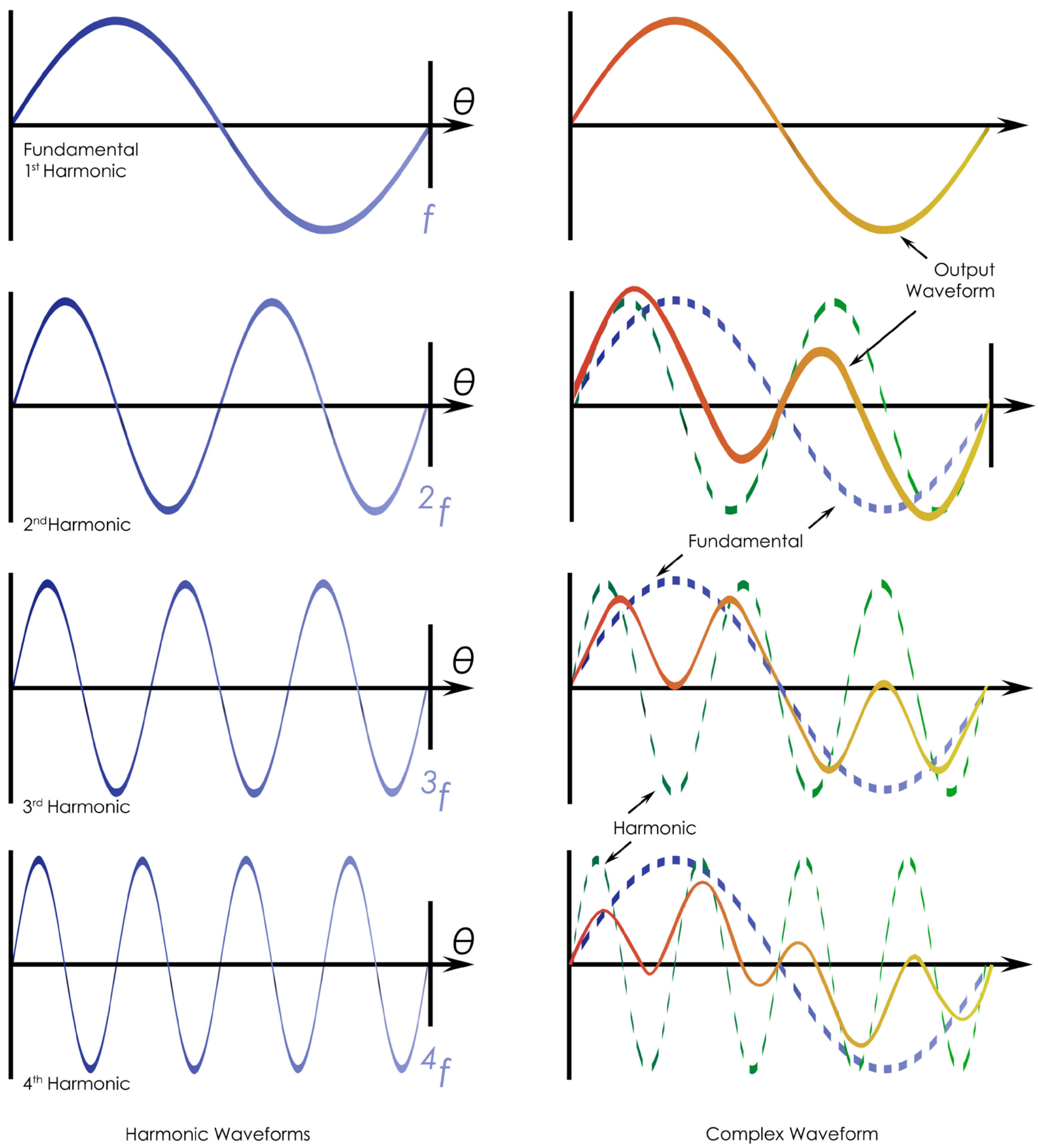

Figure 2. Typical harmonic waveforms.

6. Flux Transfer Period of Planets

Flux transfer events are a characteristic set of perturbations in the magnetic field observed by satellites near the Earth's magnetopause. It has been observed that these events occur every 5 to 15 minutes [8].

To better understand the period of these events and work towards a useful, dual purpose, mechanical electrical engineering explanation, I have calculated the period of flux transfer events using acoustic string theory calculations (Table 1). Gravity has been substituted directly for string tension and the distance from the Sun to the respective planets is used as the length of the musical string. One can imagine the solar system as a symphony of planets each connected by vibrating strings to the sun and to each other. We are attempting for the first time to read the sheet music from this enormous orchestra perched in the heavens. Perhaps Beethoven was inspired by the low frequency sounds that only his ear could discern. By using the most basic of acoustic string equations, we can determine linear and/or charge density of the plasma, as well as the frequency and period of the traveling electromagnetic wave.

7. Schumann Resonance

This Earth's electromagnetic resonance is named after physicist Winfried Otto Schumann who provided mathematical proof in 1952. The current thought is that Schumann resonances occur because the space between the surface of the Earth and the conductive ionosphere acts as a closed waveguide. The limited dimensions of the Earth cause this waveguide to act as a resonant cavity for electromagnetic waves in the ELF band. The cavity is naturally excited by electric currents in lightning. Schumann resonances are the principal background in the part of the electromagnetic spectrum from 3 Hz through 60 Hz and appear as distinct peaks at extremely low frequencies (ELF) around 7.83 Hz (fundamental).

Using string theory, we are able to calculate the frequency of the electromagnetic wave to produce the ideal value of 11.75 Hz [9].

Table 1. Period of flux transfer events.

	Tension	Distance to Sun	gm/m	Frequency	Period
Mercury	1.3×10^{22} N	58 Bm	1.44×10^{8} N	0.0025 Hz	6 min
Venus	5.66×10^{22} N	108 Bm	6.25×10^{8} N	0.0014 Hz	12 min
Earth	3.54×10^{22} N	150 Bm	9.33×10^{8} N	0.0010 Hz	16 min
Mars	1.65×10^{21} N	228 Bm	1.83×10^{7} N	0.0065 Hz	2 min
Jupiter	4.12×10^{23} N	778 Bm	4.57×10^{9} N	0.00019 Hz	87 min
Saturn	3.72×10^{22} N	1427 Bm	4.13×10^{8} N	0.00010 Hz	166 min
Uranus	1.40×10^{21} N	2871 Bm	1.55×10^{7} N	0.00005 Hz	333 min
Neptune	6.6×10^{20} N	4497 Bm	7.3×10^{6} N	0.00003 Hz	555 min

$$\text{Velocity } c = 3\times10^{8}\ \text{m/s}$$

$$T = \text{Gravity Earth} = 9.8\ \text{N} = 2.21\ \text{lbs} = 1\ \text{kg}$$

$$L = \text{Diameter of Earth} = 12756000\ \text{meters}$$

$$\frac{m}{L} = 1.0\ \text{g/m}$$

The following ideal numbers is then calculated, which is the same value Schumann calculated using his equation.

$$f = 11.75\ \text{Hz}$$

8. COrE Satellite and Cosmic Strings

A cosmic microwave background satellite is being proposed that will map the microwave of the sky with high precision. The COrE (Cosmic Origin Explorer) mission will lead to breakthrough science in a wide range of areas, ranging from primordial cosmology to galactic and extragalactic science. COrE is designed to detect the primordial gravitational waves generated during the epoch of cosmic inflation. Microwave frequency is inversely proportional to distance. The distance between bodies was very near shortly after the "big bang" moment. At 162 - 262 Giga hertz, the wavelength is in the millimeter ranges. This tells us that things were very small at the time of the "big bang". The concentration of micro wave frequency would be expected to be clustered in the higher microwave range, and then gradually inflate over the millennia. Measuring and mapping microwave frequency for events occurring right after the "big bang" makes engineering sense and COrE is a worthwhile feasible project [10].

However, we know that the universe expanded rapidly after the "big bang" and therefore distances between magnetic bodies and corresponding wavelengths are long. Since frequency is inversely proportional it follows that frequency will be small and time periods will be large. If the stated goal is to measure gravitational waves occurring in real time, and flux transfer events then microwave frequency won't be successful. Microwave is perfect for the "big bang" era when everything was close together, but for the universe that we live in today, where planets are millions of kilometers apart; microwave is not a good choice as a measurement tool.

Direct measurement of Tremendously Low Frequency (TLF) waveforms would be the ideal method of investigating Flux Transfer between the sun and planets. In the authors opinion (TLF) measurements for detecting gravitational waves existing now, as opposed to the "big bang" era, would also be superior because of wavelengths involved and the unusual low frequency range. Tremendously low frequency (TLF) measurements have never been performed since long antenna lengths required in measuring equipment is prohibitive. Unfortunately, (TLF) is not a feasible engineering choice for a small satellite.

Therefore, it is suggested that adding a second low radio frequency radio antenna to gather additional information from COrE, and then extrapolating results might be useful based on the frequency after the "big bang" event and the inflation rate time graphed to our solar system. Scaling factors might be used to detect fundamental and harmonic waveforms during flux transfer events. The scaling factors for microwave would be too large to be comprehensible and therefore the longest antenna length feasible for the COrE satellite should be added to detect gravity waves, even if they are harmonics of the fundamental.

We know that the four previous satellites were not successful in detecting gravity waves or cosmic strings using microwave frequency. To use the same technology and expect a different result deserves critique. LIGO and advanced Virgo have reported success using low frequency detection, though the detector circuits are far apart. Electromagnetic waves have been reported to accompany the gravity waves. Sending up a pair of satellites each with a LIGO type detector and then varying the distance apart of the satellites in 3-meter increments would be an alternative approach to graphing the entire frequency band of the cosmos, and thus map the universe as it exists today. Listening for frequencies that match those of earth would be a simple of way of finding similar planets to earth.

Henry Tye and others predicted the production of cosmic superstrings during the last stages of brane inflation, a specific realization of the inflationary in the early universe within framework of string theory. In 2006 Henry Tye wrote the following:

"*If string theory is the theory of everything, we should be able to find a natural inflationary scenario there. This will allow us to identify the inflation and its properties, while at the same time cosmological measurements will help us to determine the precise stringy description of our universe. With some luck, we may even find distinct stringy signatures in this framework in the cosmological data to confirm our faith in the theory. Since the inflationary scale turns out to be comparable to the string scale, such an investigation is clearly very worthwhile*" [11].

String theorist Joseph Polchinski wrote that the expanding universe could have stretched a "fundamental" string until it was of intergalactic size. Such a stretched string would exhibit many of the properties of the old "cosmic" string variety, making the basic string calculations useful again. [12] Cosmic strings stretched to intergalactic scales would radiate gravitational waves, they should also cause harmonics in the cosmic microwave background, too subtle to have been detected yet but possibly within the realm of future observability of COrE. Cosmic strings provide a window into string theory. If cosmic strings are measurable which is a real possibility for a wide range of cosmological string models this would provide the first experimental evidence of a string theory model underlying the structure of spacetime.

A string is a geometrical deviation from Euclidean geometry in spacetime characterized by an angular deficit: a circle around the outside of a string would comprise a total angle less than 360˚. From the general theory of relativity such a geometrical defect must be in tension and would be manifested by mass. Even though cosmic strings are thought to be extremely thin, they would have significant density, and so would represent a potential gravitational wave sources. The pinnacle of future experimentation would be to confirm that cosmic strings or planetary strings or strings in general are in fact electromagnetic waves exhibiting a standard Lorentzian force derived from combined centripetal and gravitational force vectors. There may be a heretofore practical engineering explanation for strings theory as electromagnetic waves not considered or perhaps overlooked. Such as a discovery might interpret an orderly magnetic cosmos to astrophysicist and would also translate into a meaningful earthly discovery of electromagnetic waves.

For example, in the real world, we know that primary cables to arc furnace transformers move around violently when the secondary of the transformer is short circuited to melt metal. However, the motion of the primary cables is only partially explained by the Lorentz force. String theory analysis from the cosmos may lead to new understanding and an improved Lorentz force equation.

9. Conclusions

Researchers have reported that the Earth's magnetopause observations by the ISEE satellites indicate that the distribution of the intervals between flux transfer events has a mode value of 3 min. However, the number is highly inaccurate, having upper and lower decile values of 1.5 min and 18.5 min, respectively. The mean repetition rate of the Earth's flux transfer events is ~8 min [13].

My calculations for the Earth compare favorably with the spectrum of readings observed. It is likely that satellite observations and analysis are not accounting for harmonic multiples of the fundamental frequency of flux transfer events. Non-sinusoidal complex waveforms are constructed by "adding" together a series of sine wave frequencies known as "Harmonics". Harmonics is the generalized term used to describe the distortion of a sinusoidal waveform by waveforms of different frequencies. Whatever its shape, a complex waveform can be split up mathematically into its individual components called the fundamental frequency and a number of "harmonic frequencies". It is not entirely surprising that observations of the mean value are at or near the 2^{nd} harmonic calculation or 8-minute mark, or that the 3^{rd} harmonic is close to the 5.6 minute observed mark. The theoretical calculation aligns fairly closely with the observed one, when harmonics are included.

It is recommended that flux transfer waveforms are collected by satellites and harmonic analysis is performed on several planets to confirm that measured data matches theoretical calculations. Successful completion of this task would affirm that String Theory applies to everything from quarks to planets. I also note that the frequencies of the various planets' flux transfer systems are nowhere near Schuman Resonance. This affirms that the Earth's resonance operates at different fundamental and harmonic frequencies than that of the solar system.

The work suggests that what we typically refer to as the force of attraction and repulsion in magnetic bodies is a force of tension and compression derived from tremendously low frequency (TLF) waves that can be modeled using string theory. This is a profound finding as it implies that magnetism is a tremendously low frequency wave phenomenon, and not a plus or minus dipole-oriented problem. Gravity is thus similarly equated to tension and expressed in Newtons of force. The term gravity wave is given new perspective in terms of string tension and a traveling electromechanical wave. A string of electrons may in fact be an electron string connecting one planet to another, electrically and mechanically. The force of attraction connecting the individual electrons into a long string of electrons may be the resultant force of charged particles, which perhaps could be approximated using Coulombs law. The sum of all the electron charge forces should equate to the total tension force.

Gravity waves were originally discussed in 1893 by Oliver Heaviside referencing the relationship of the inverse-square law in gravitation and electricity [14]. Henri Poincaré in 1905 first proposed gravitational waves emanating from a planet and traveling at the speed of light. Poincaré suggests the following analogy: like an accelerating electrical charge producing an electromagnetic wave, accelerated masses in a relativistic field theory should produce gravitational waves [15]. Based on results of cosmic string theory, I am proposing that gravitation waves and electromagnetic waves are more than just an analogy; they may be the same electromechanical wave traveling between planets. Gravity waves are thought to be weak mechanical forces similar to the forces on a wire carrying current as defined by Lorentz force calculation.

In regards to the Lorentz force it is noteworthy that Oliver Heaviside invented the magnetic vector notation and applied it to Maxwell's field equations. The 1895 Hendrik Lorentz formula includes the contributions to the total force from both the electric and the magnetic fields. Lorentz moved away from the Maxwellian descriptions of ether and conduction. Instead, a distinction between matter and the luminiferous aether was made. Lorentz applied the Maxwell equations at a microscopic scale by applying Heaviside's version of the Maxwell equations for stationary ether and applying Lagrangian mechanics [16].

It would be a wonderful tribute to Oliver Heaviside, Henri Henri Poincaré and Henrik Lorentz if gravity waves and electromagnetic waves could be proven to be the same wave interconnecting planets like strings of a violin. It is believed that COrE experiments and data measurements could be tailored to prove string theory once and for all.

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